THE TREATMENT OF TUBERCULOUS LARYNGITIS WITH CULTURE PRODUCTS, WITH OBSERVATIONS UPON THE ACTION OF SPECIFIC INOCULATIONS IN THE TREATMENT OF TUBERCULOSIS.[1]

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TUBERCULOUS laryngitis has long been looked upon as a most hopeless complication of a hopeless disease. The past quarter of a century has removed this hopelessness from pulmonary tuberculosis; through wider knowledge has come early recognition of the disease, and through rational treatment its curability has become established. Tuberculous laryngitis, however, still remains a serious complication, although its curability has been proved.

The importance of this complication cannot be underrated, since it is present in a large proportion of the patients suffering from pulmonary tuberculosis. There is a wide divergence of opinion as to its frequency. Percy Kidd[2] estimates that 50 per cent. of the subjects dying of tuberculosis have the larynx affected. St. Clair Thompson[3] accepts this percentage as correct. Schaeffer[4] found only 8 (or 2.6 per cent.) normal larynges in 310 persons suffering from pulmonary tuberculosis. Of these 64.6 per cent. were diagnosed as tuberculous. Heinze[5] found laryngeal tuberculosis 376 times (or 30.6 per cent.) in 1226 postmortem examinations on tuberculous subjects at the Leipzig Pathological Institute. Schech[6] found the larynx affected in 30 per cent. of tuberculous subjects, while Turban[7] found only 74 instances (or 18.3 per cent.) among 408 cases of pulmonary tuberculosis. Von Ruck[8] found tuberculous laryngitis, which could be diagnosed by ordinary inspection, in 260 (or 45.6 per cent.) of 570 cases. Careful inspection, however, after the administration of tuberculin revealed 166 more, making a total of 426 (or 74.73 per cent.). Of 94 cases which I reported recently there were 15 (or 15.95 per cent.) with laryngeal involvement of such a degree as to cause subjective symptoms. Of 65 patients in the Pottenger Sanatorium at the present time 27 (or 41.54 per cent.) either have had or have now sufficient involvement for the diagnosis to be made by inspection. Thus it will be seen that my percentage of cases recognizable on simple inspection does not fall far short of that of von Ruck. It should be added, too, that most of the laryngeal involvements are in those who are in the advanced stage of the disease. If our inquiry were confined to the advanced cases there is no doubt that more than 50 per cent. would show tuberculous laryngitis, thus confirming the percentages of Kidd, St. Clair Thompson, and Schaeffer.

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[1] Read at the meeting of the National Association for the Study and Prevention of Tuberculosis, Washington, D. C., May 17 and 18, 1906.

[2] Clifford Allbutt's System of Medicine, vol. v.

[3] The Principles of Treatment of Tuberculous Laryngitis, Trans. British Congress on Tuberculosis, vol. iii, p. 356.

[4] Cited by A. Fraenkel, Specielle Pathologie und Therapie der Lungenkrankheiten, p. 776.

[5] Die Kehlkopfschwindsucht, 1879.

[6] Heyman's Handbuch, Wien, 1898.

[7] Beiträge zur Kentniss der Lungentuberkulose, Wiesbaden, 1899.

[8] Journal of Tuberculosis, 1903, vol. v, and Report of the Winyah Sanatorium for 1903 and 1904.

Tuberculosis of the larynx manifests itself most often in the form of infiltration. Sometimes this infiltration breaks down and forms ulceration. Tuberculomas are sometimes formed; miliary tubercles are occasionally seen; and less often the disease manifests itself as a perichondritis.

The diagnosis of tuberculous laryngitis is largely a matter of experience. The physician who is in the habit of seeing these cases often will rarely be mistaken. The disease is usually secondary, and rarely occurs unless the lungs are affected. It is most commonly found when the pulmonary condition is somewhat advanced. While it must be borne in mind that a tuberculous patient is subject to all the forms of non-tuberculous throat trouble, yet repeated examinations by a skilled laryngologist will rarely fail to differentiate the tuberculous from the non-tuberculous. In this, as in other forms of tuberculosis, an early diagnosis is very desirable, since the prognosis is much more favorable in slight infiltration than it is in extensive infiltration with great thickening or after ulceration has occurred.

The prognosis in tuberculous laryngitis has always been considered grave. In fact, I believe it is the opinion of nearly all physicians that when the throat becomes affected there is no hope. Sir Morrell Mackenzie[1] wrote in 1880: "The prognosis is always extremely grave, and it is not certain that any cases recover." Lennox Browne[2] in 1893 said: "The prognosis is seldom doubtful, and we are not justified in giving other than an unfavorable prognosis either as to recovery of health or duration of life." West[3], in 1902, shared the general hopeless view, saying: "The prospects of cure are very slight." Lake[4], in 1905, took a much more hopeful view, saying: "If tuberculous laryngitis is treated from its commencement, the disease can be controlled, in very many cases completely cured, and in others the onset of severe symptoms can be prevented." Tyson[5] in 1906 says: "The prognosis of tuberculous laryngitis is unfavorable at best."

[1] Quoted by Lake, Laryngeal Phthisis, 1905, p. 85.

[2] Diseases of the Throat, 1893, p. 418.

[3] Diseases of the Organs of Respiration, p. 81

[4] Ibid.

[5] Practice of Medicine, fourth edition, 1906, p. 512.

In order to substantiate his favorable prognosis Lake[1] says: "In the first edition of this work I recorded 48 cures out of 329 cases (or 14.59 per cent.); and from 1901 to 1903 inclusive, I have to record, out of 211 cases, 44 cures (or 20.85 per cent.) and 14.21 per cent. 'much improved.' The 'cures' include all cases discharged from the hospital with no visible lesion of the larynx (scars, etc., excepted); many cases were in an early stage, and many very slight cases of cord trouble are included." This very gloomy picture showing only one out of five cases of tuberculous laryngitis as cured when "many cases were in an early stage, and many very slight cases of cord trouble are included," is one of the brightest that can be found. It is even dazzling when compared with others.

How different this is from the report of von Ruck,[2] who obtained either a disappearance of all signs or a condition no longer reacting to tuberculin in 353 (or 82.86 per cent.) of 426 cases of laryngeal involvement treated at the Winyah Sanitarium.

In a recent paper[3] I reported 94 cases of pulmonary tuberculosis complicated in 15 instances by laryngeal tuberculosis, all of which were sufficiently advanced to cause symptoms on the part of the patient. Of these 15 cases there was apparent healing, so that there was no further reaction to tuberculin (in 11 or 73.33 per cent.). In one other case there was a healing of a large ulcer and an arrest of activity, although the patient still reacted to tuberculin. At the last report, which was more than a year after discharge, the throat was still in an arrested condition. To these could be added several more patients who are cured of their laryngeal involvement, but who are still under treatment for their pulmonary condition, but I will confine my report to these 15 cases.

These results are so different from those usually obtained, and so out of harmony with the prognosis usually given, that I shall give brief notes of the case-histories, together with the final results.

Case 133. Female, aged twenty-eight years; history positive; ill four years; dense infiltration and cavity in the right upper lobe; both cords, interarytenoid space, and both arytenoids infiltrated; weight 114 pounds; temperature 99.5°; pulse 90; digestion good; bacilli present; sputum, one-half ounce in twenty-four hours. Treated two years; on discharge pulmonary lesion healed; weight 130 pounds; temperature 98.6°; pulse 75; digestion good; bacilli absent; lungs and larynx apparently cured.

Case 166. Female, aged thirty-one years; history positive; ill four years and eleven months; infiltration in both upper lobes and the upper portion of the right lower lobe posteriorly; a cavity in the right upper lobe; infiltration of both cords and both arytenoids with tumefaction; weight 123 pounds; temperature 98°; pulse 108; digestion good; bacilli present; sputum, two ounces in twenty-four hours. Duration of treatment, eleven months; on discharge a few rales at the site of the cavity; weight 130 pounds; temperature 98.4°; pulse 81; digestion good; bacilli present; sputum scant; larynx apparently cured; pulmonary condition arrested.

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[1] Laryngeal Phthisis, 1905, p. 85.

[2] Loc. cit.

[3] Results of Treatment in Ninety-four Cases of Pulmonary Tuberculosis, Therapeutic Gazette, September, 1906.

Case 183. Male, aged thirty-five years; history negative; ill three years and six months; dense infiltration of the entire left lung and the upper lobe of the right; a cavity in the left upper lobe; both cords ulcerated; interarytenoid space infiltrated; weight 114 pounds; temperature 100.8°; pulse 96; digestion good; bacilli present; sputum, four ounces in twenty-four hours. Duration of treatment, nine months; on discharge infiltration lessened throughout; weight 119 pounds; temperature 100.2°; pulse 100; digestion good; bacilli present; sputum, four ounces in twenty-four hours; larynx and pulmonary condition unimproved.

Case 192. Male, aged twenty-six years; history negative; ill four years; dense infiltration in both upper lobes; foci scattered throughout the rest of the lungs; a cavity in right upper lobe; aphonia; both cords infiltrated and the right ulcerated; tumefaction of both arytenoids; weight 112 pounds; temperature 101°; pulse 100; digestion poor; bacilli present; sputum, three ounces in twenty-four hours. Duration of treatment, six months; on discharge slight infiltration of both upper lobes; weight 118 pounds; temperature 100.6°; pulse 96; digestion fair; bacilli present; sputum, two ounces in twenty-four hours; larynx and pulmonary condition improved.

Case 201. Female, aged thirty-one years; history positive; ill one year and two months; dense infiltration of the entire left lung; infiltration of the interarytenoid space; weight 107 pounds; temperature 102°; pulse 120; digestion poor; bacilli present; sputum, one ounce in twenty-four hours. Duration of treatment, six months; on discharge slight lesion of the left apex; weight 131 pounds; temperature 98.6°; pulse 90; digestion excellent; bacilli absent from sputum; larynx apparently cured; pulmonary condition arrested.

Case 202. Female, aged twenty-one years; history positive; ill five years and nine months; infiltration of the entire right lung with cavity in the upper lobe; infiltration of the left upper lobe; infiltration of the interarytenoid space and both arytenoids; weight 75 pounds; temperature 99.6°; pulse 96; digestion poor; bacilli present; sputum, three ounces in twenty-four hours. Duration of treatment, nine months; a few rales about the cavity, otherwise clear; weight 99¾ pounds; temperature 98.6°; pulse 78; digestion good; bacilli present; sputum, one and one-fourth ounces in twenty-four hours; larynx apparently cured; pulmonary condition arrested.

Case 204. Female, aged thirty-five years; history positive; ill five years; dense infiltration of the entire right lung; cavity formation in the upper lobe; recent infiltration of the left upper lobe;

aphonia; both cords with interarytenoid space, and both arytenoids infiltrated; weight 115 pounds; temperature 104°; pulse 110; digestion poor; bacilli present; sputum, four ounces. Duration of treatment, one year; on discharge a few rales about the cavity; weight 140 pounds; temperature 98.6°; pulse 76; digestion excellent; bacilli present; sputum, one-half ounce in twenty-four hours; larynx apparently cured; pulmonary condition arrested.

Case 215. Female, aged thirty-two years; history negative; ill three years and three months; dense infiltration of both upper lobes; slight infiltration of interarytenoid space; pleurisy with effusion; weight 125 pounds; temperature 102°; pulse 102; digestion poor; bacilli present; sputum, one-half ounce in twenty-four hours. Duration of treatment, one year; on discharge left lung nearly clear; slight infiltration of the right upper lobe; weight 138 pounds; temperature 99°; pulse 90; digestion good; bacilli present; sputum scant; larynx apparently cured; pulmonary condition improved.

Case 218. Male, aged forty-six years; history positive; ill eighteen years and three months; dense infiltration of the left lung; moderate infiltration of the right upper lobe; cavity in the right lobe; infiltration of both arytenoids and interarytenoid space; weight 131½ pounds; temperature 99.2°; pulse 96; digestion poor; bacilli present; sputum, two ounces in twenty-four hours. Duration of treatment, three months; on discharge moderate infiltration of the left upper lobe; weight 151 pounds; temperature 98.6°; pulse 90; digestion good; bacilli present; sputum scant; larynx apparently cured; pulmonary condition arrested.

Case 297. Female, aged thirty-nine years; history positive; ill one year and five months; dense infiltration of the right upper lobe; moderate infiltration of the middle and right lower and left upper lobes; slight infiltration of the interarytenoid space; weight 110½ pounds; temperature 98.8°; pulse 90; digestion good; bacilli present; sputum scant. Duration of treatment, eight months; on discharge pulmonary lesion healed; weight 124 pounds; temperature 98.6°; pulse 80; digestion good; bacilli absent; sputum none; larynx apparently cured; pulmonary condition apparently cured.

Case 308. Male, aged forty-five years; history negative; ill one year and three months; slight infiltration of the right upper lobe; slight infiltration of the interarytenoid space; weight 140 pounds; temperature 98.4°; pulse 68; digestion good; bacilli present; sputum scant. Duration of treatment, three months; on discharge, lungs clear; weight 151 pounds; temperature 98.4°; pulse 70; digestion good; bacilli absent; sputum scant; larynx apparently cured; lungs apparently cured.

Case 263. Male, aged forty years; history positive; ill one year and nine months; dense infiltration of the entire left lung and upper lobe of the right lung; scattered infiltration of the lower lobe of the right lung; infiltration of both cords with ulceration; interarytenoid space and both arytenoids infiltrated; weight 164 pounds; temperature 99°; pulse 96; digestion good; bacilli present; sputum, one ounce in twenty-four hours. Duration of treatment, ten months; on discharge left lung nearly clear; dense infiltration of the right upper lobe; scattered foci through the middle and lower lobes; patient suffering from hydropneumothorax; weight 140 pounds; temperature 102°; pulse 120; digestion poor; bacilli present; sputum two ounces in twenty-four hours; larynx unimproved; pulmonary condition unimproved.

Case 18. Male, aged thirty-two years; history positive; ill nine years and six months; dense infiltration of the entire left lung; slight infiltration of the right upper lobe; infiltration of both cords; weight 145 pounds; temperature 99°; pulse 84; digestion fair; bacilli present; sputum, two ounces in twenty-four hours. Duration of treatment, two years and six months; on discharge slight infiltration at left apex; weight 159 pounds; temperature 98.6°; pulse 66; digestion good; bacilli present; sputum, one-fourth ounce in twenty-four hours; larynx apparently cured; pulmonary condition arrested.

Case 47. Male, aged twenty-seven years; history positive; ill four years; dense infiltration of the right upper lobe with cavity; moderate infiltration of the entire left lung; aphonia; infiltration of both cords with ulceration; ulcer in the interarytenoid space; infiltration of both arytenoids; weight 112 pounds; temperature 100.4°; pulse 84; digestion poor; bacilli present; sputum, one ounce in twenty-four hours. Duration of treatment, one year and five months; on discharge slight signs about cavity; weight 118 pounds; temperature 100°; pulse 100; digestion fair; bacilli present; sputum, one and one-half ounces in twenty-four hours; larynx apparently cured; pulmonary condition improved.

Case 56. Female, aged thirty years; history negative; ill three years and one month; moderate infiltration of the entire left lung and upper lobe of the right; infiltration of the right cord; right ventricle bulging with ulcer; both arytenoid and interarytenoid spaces infiltrated; weight 94 pounds; temperature 101°; pulse 120; digestion good; bacilli present; sputum, six ounces in twenty-four hours. Duration of treatment, one year and ten months; on discharge slight infiltration of the left upper lobe; weight 97¼ pounds; temperature 99.6°; pulse 84; digestion good; bacilli present; sputum, three ounces in twenty-four hours; condition of larynx, arrested; pulmonary condition arrested.

Before entering upon the subject of treatment, I wish to say a few words about early diagnosis. It is not necessary to emphasize the necessity of early diagnosis in pulmonary tuberculosis, but I feel that we should broaden our teaching and insist upon the early diagnosis of tuberculosis wherever found. We should not be satisfied with an examination of the chest, but we should examine for tuberculosis elsewhere; above all, the larynx should never be neglected; for even conservative men estimate that one-third of those who have pulmonary tuberculosis have the larynx affected, and the evidence is quite clear that one-half would be within the truth.

As the time to treat pulmonary tuberculosis is in its incipiency, so is this the time to treat the laryngeal form of the disease, since the prognosis becomes graver the farther advanced the condition.

In treating laryngeal tuberculosis, it must be borne in mind that it is nearly always secondary to tuberculosis elsewhere, usually in the lung; and any treatment that is expected to be of value must include the treatment of the other conditions present. We must not expect to heal tuberculosis of the larynx by local applications in very many cases, nor must we expect to accomplish our results quickly. It is a matter of time and patience. We must not expect very satisfactory results except in institutions where the patients are under constant care and guidance and where they can be cared for for a prolonged period of time.

The indications for treatment are the same as for the treatment of tuberculosis elsewhere: (1) To increase the resisting power of the patient; (2) to prevent the disease from spreading to new tissue; and (3) to heal the local lesion.

The resisting power of a patient is supposed to depend very largely upon his nutrition, hence all that tends to improve this, such as open-air, hygienic living, good food, carefully regulated rest and exercise, hydrotherapy, and various other tonic measures find place in the treatment of tuberculous laryngitis.

In order to cure the local ulceration, Krause[1] introduced lactic acid in 1885; and, in 1887, Heryng[2] advocated the curetting of the tuberculous process and after-treatment with lactic acid, hoping in this way to eradicate the disease. While this surgical treatment is not founded on a rational basis, because it is not often possible to extirpate all the diseased area and if healing takes place ulceration usually soon supervenes again, yet the work of Krause and Heryng undoubtedly has done much to advance the treatment of this affection by calling attention to the fact that it can sometimes be cured.

To prevent the disease from spreading, and to heal the local lesion we have one method of treatment which offers great hope, that is inoculation. Inoculation of specific toxins imitates nature's method of curing disease. Recent studies in immunity show that the specific antibodies which bring about a cure in diseases of microbic origin are produced by stimulation of the body cells by means of specific toxins. If the quantity of toxin is small, the cell responds by the formation of antibodies; if the quantity of toxin is large, the cell is destroyed and the cure prevented. Therefore, by the inoculation of specific toxins in the proper amounts we can increase the defensive powers of the organism. That this occurs I believe from clinical experience, and can be proved by laboratory methods.

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[1] Berl. klin. Woch., 1885.

[2] Die Heilbarkeit der Larynxphthisis und ihre chirurgische Behandlung.

The toxin used in the treatment of tuberculosis is usually known as tuberculin. Tuberculin is a broad term which includes several different preparations, as old tuberculin and new tuberculin (Koch), Hunter's modification of old tuberculin, antiphisin (Klebs), tuberculin (Denys), tuberculin (Beraneck), watery extract of tubercle bacilli (von Ruck), P.T.O. (Spengler), and numerous others. The action of all these various tuberculins is similar in part, yet different. Some are much safer to use than others and some seem to produce better results than others.

My experience with P.T.O. (Spengler) is very encouraging. P.T.O. is made from bovine bacilli. Its use will throw light upon the question of the identity and intertransmissibility of bovine and human bacilli. These tuberculins are very different. P.T.O. will immunize against the human toxin much stronger than the human will against the bovine toxin, for example: when we have carried our dosage of P.T.O. up to say 100 mg., we can begin and within a very short time attain a high dosage of human tuberculin. When we have arrived at a dosage of 100 mg. of human tuberculin, however, and wish to change to P.T.O. we must increase our dosage of P.T.O. much slower. P.T.O. will also raise the agglutinating power of the blood to a much higher degree than the human tuberculin, and this power of agglutination will last longer.[1] The reactions from the products made from bovine and human bacilli differ also.

The preparation which I have used for the most part and the one which I have used in all the cases reported herewith is the watery extract of tubercle bacilli (von Ruck). This preparation is made from the powdered bodies of tubercle bacilli, by extraction with distilled water after the culture fluid has been removed by washing and the fats by extraction with alcohol and ether. The product is standardized so that a given solution known as Solution No. 100, represents 1 per cent. of the solid matter derived from the bodies of the bacilli by the above method of extraction. The dilution is made with normal salt solution to which 0.4 per cent. of carbolic acid has been added. This preparation represents a greater amount of soluble extract from the bodies of the bacilli than any other, and hence is presumably superior in its immunizing properties. It is a stable preparation and can be kept for months without deteriorating, which facilitates ease and economy of administration.

In order to understand the manner in which these remedies produce their beneficial action, it is well to inquire into the manner in which the disease spreads in the body and also into nature's way of effecting a cure. Tuberculous processes usually show a tendency to spread to adjacent parts, and the lesion itself heals very slowly, if at all. Any remedy then that will stimulate healing in the local lesion and any remedy that will counteract the tendency of the disease to spread will meet the two principal indications in the treatment of tuberculosis.

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[1] Ein neues immunisierendes Heilverfahren der Lungenschwindsucht mit Perlsuchttuberculin, Deut. med. Woch., 1905, Nos. 31 and 34.

Man, when in health, is naturally resistant to tuberculosis. He is able to take moderate quantities of tubercle bacilli into his system without infection resulting. The normal resisting power of the body overcomes the invading organisms. If, however, the number of bacilli becomes greater, or if the inoculation be of a very resistant race of bacilli, or if the normal resisting power of the individual be lowered, infection is likely to occur.

Here, then, lies the explanation why tuberculosis is easier to cure when the lesion is small. There are fewer areas from which the disease is attempting to spread and consequently the defensive powers of the organism are not so heavily taxed in destroying the bacilli which are attempting to form new foci; and the larger the focus the more the natural defenses of the organism are depressed. This also explains why the maintenance of nutrition, as is done by the hygienic-dietetic-open-air treatment, is so important. A high degree of nutrition enables the organism to form more defensive bodies than a low degree.

That the natural resisting power of the organism is lowered when an infection occurs has been shown by the important works of Bullock[1] in determining the opsonic power of the blood.

When an organism has been infected with a certain micro-organism, the power of the blood for destroying that specific organism becomes lowered. In individuals suffering from tuberculosis, this power is sometimes reduced a quarter, a half, or even three-quarters.

The opsonic power of the blood can best be raised by inoculation with a specific toxin. If the individual be suffering from a staphylococcic infection, the opsonic power of his blood toward the staphylococcus is lowered and can be increased by inoculation of staphylococcic vaccine; if a tuberculous infection, the opsonic power is raised by inoculation of toxins from the tubercle bacillus or tuberculin.[2] By the proper use of tuberculin, the opsonic power of the organism can be raised from one-quarter, one-half, or three-quarters of the normal to above normal.

Tuberculin, then, is indicated in the treatment of tuberculosis because it will increase the power of the blood to destroy bacilli, thus aiding in the destruction of the germs in the foci which are present, and also protecting the organism against further invasion. One of the difficulties encountered in the treatment of tuberculosis lies in the fact that the bacilli are shut up in the tubercles where the blood cannot reach them easily. Hence, cure is slow. The organisms which make their way out of the tubercles, however, and which tend to set up lesions in adjacent or distant parts can be reached more easily, and if they can be bathed in a serum rich in protective substances, they will be destroyed before they can cause infection; unless, as stated above, they be very virulent or come in too large quantities.

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[1] On the Variation of the Opsonic Power in Health and Disease, London Hospital Gazette, March, 1905, xi; Inquiry into the Opsonic Content of the Blood Serum in Healthy Individuals and in Patients Affected by Lupus, Trans. Path. Soc. Lond., 1905, vol. lvi, p. 334.

[2] For a review of the literature see Potter, Ditman, and Bradley, AMER. JOUR. MED. SCI., August, 1906, cxxxii, 186.

Tuberculin does more than this. It stimulates the tuberculous focus and hastens healing. Following an injection of the proper dose of tuberculin a slight hyperemia of the area involved occurs; this passes off sometimes within a few hours, sometimes after two or three days. By keeping up this stimulation at proper intervals for sufficient time, we assist nature very materially in her effort to cure the lesion.

The larynx is the ideal location for a lesion to be treated by tuberculin, for the dosage can be controlled absolutely by the local reaction produced. The larynx should be watched daily and the dosage should not be increased beyond that which is necessary to produce a slight reaction; nor should a second injection be given until all reaction produced by the first has disappeared.

Tuberculin administered in this manner will cure many cases of tuberculous laryngitis. It will increase the chances of recovery in these cases from 50 to 75 per cent., and in many cases it offers practically the only hope.

In conjunction with it, all measures which will improve nutrition should be used. The local lesion should be kept clean by suitable bland sprays. If ulcerations are present they may be treated with protargol, 10 per cent., and if painful should be dusted with orthoform. At times when pain is excessive and cough very troublesome, this may be allayed by adding $\frac{1}{12}$ grain of heroin hydrochlorate to the orthoform. Rest of the larynx should be insisted upon. The patients should be requested to talk as little as possible, and when necessary, preferably in a whisper. A cold compress to the throat at night aids in relieving cough. Focusing the sun's rays upon the parts affected, after the method of Sorgo,[1] or using the violet rays, seems to aid somewhat, perhaps by causing an increase of blood to the parts and thus affording greater opportunity for the protective action of the serum. I have never found it necessary to resort to operative procedures, nor have I used any remedies of severe action.

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[1] Ueber die Behandlung der Kehlkopftuberkulose mit Sonnenlicht nebst einem Vorschlag zur Behandlung derselben mit künstlichen Lichte, Wien. klin. Woch., 1905, vol. xviii, No. 4.